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United States
Department of
Agriculture

Animal and
Plant Health
Inspection
Service

Veterinary
Services

Transfer of Maternal Immunity to Calves

National Dairy Heifer Evaluation Project

Over 40 percent of dairy heifer calves have immunoglobulin G (IgG) levels of less than 1,000 mg/dl (milligrams per deciliter). Data presented here suggests that 22 percent of total calf deaths could be avoided by ensuring adequate colostrum intake which would lead to higher IgG levels.

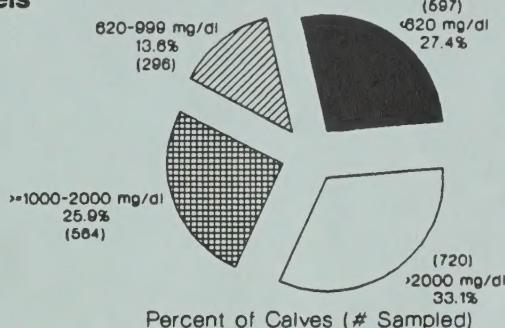
Calves are born without immunity to the numerous infectious agents to which they are inevitably exposed during their first 3 months of life. Ingestion of colostrum, the first milk produced by the mother, is nature's way of providing immunity to newborn calves. Colostrum contains antibodies (immunoglobulins) to the infectious agents to which the mother has been exposed, which are generally the same agents to which the calf is destined to be exposed.

This efficient natural means for protecting calves depends upon the amount of colostrum ingested during the first few hours of life. If insufficient amounts are fed or feeding is delayed, the calf may be completely or partially unprotected.

The degree to which newborn U.S. dairy calves are protected by colostral immunity was assessed in a 1991-92 study conducted by the National Animal Health Monitoring System (USDA:APHIS:VS). The NAHMS National Dairy Heifer Evaluation Project included 1,811 farms in 28 states¹ which were selected to represent herds of 30 or more cows in those states. The sampled farms represent 78 percent of the National dairy cow population. During the study, 593 farms participated in the immunoglobulin assessment.

Blood samples were collected from 2,177 calves between 24 and 48 hours of age and tested to determine the immunoglobulin concentration. Immunoglobulin G is a class of proteins consisting almost totally of antibodies and represents nearly 90 percent of all

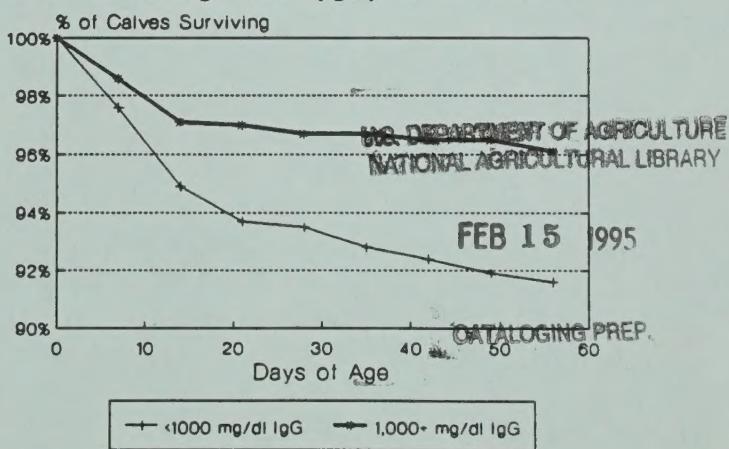
Figure 1. Distribution of Immunoglobulin (IgG) Levels



immunoglobulins transferred to calves in colostrum. Thus, immunoglobulin G (IgG) concentration is closely correlated with the sum total of antibodies against all infectious agents. Although the level at which IgG provides adequate protection varies by management situation, 1,000 mg/dl has been used because it is considered an achievable goal.²

Figure 1 shows the breakdown of IgG levels among the sampled calves. Over 40 percent of the calves had levels below 1,000 mg/dl. Over 27 percent had levels below 620 mg/dl, which was the lowest level measurable with the testing procedure used.

Figure 2. Comparison of Calf Survival Rates by Level of Immunoglobulin (IgG) Concentration



¹States participating in the National Dairy Heifer Evaluation Project (NDHEP): Alabama, California, Colorado, Connecticut, Florida, Georgia, Idaho, Illinois, Indiana, Iowa, Maine, Maryland, Massachusetts, Michigan, Minnesota, Nebraska, New Hampshire, New York, North Carolina, Pennsylvania, Ohio, Oregon, Rhode Island, Tennessee, Vermont, Virginia, Washington, and Wisconsin.

² Gay, CC. 1983. Failure of passive transfer of colostral immunoglobulins and neonatal disease in calves: a review. Proceedings, Veterinary Infectious Diseases Organization, 4th International Symposium on Neonatal Diarrhea, Saskatoon, SK, Canada.

Figure 3. Percent of Calves with Immunoglobulin (IgG) Levels of < 1,000 mg/dl by Herd Size

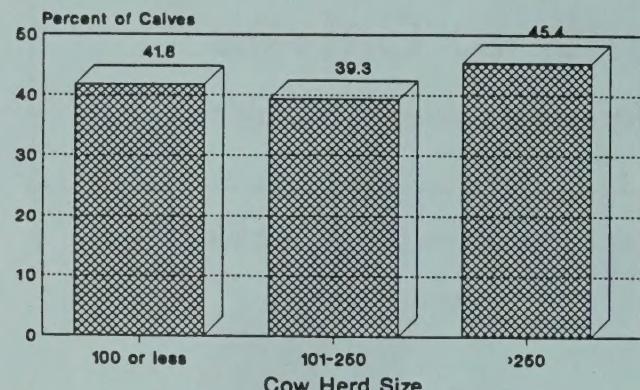
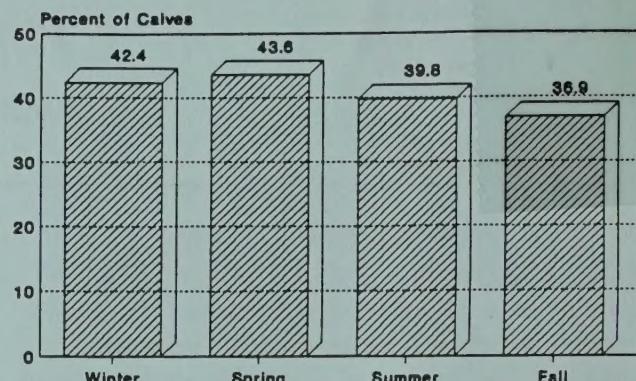


Figure 4. Percent of Calves with Immunoglobulin (IgG) Levels of < 1,000 mg/dl by Season



The reason for the concern with IgG levels is demonstrated in Figure 2. Calves with less than 1,000 mg/dl IgG experienced mortality rates over twice that of calves with higher IgG levels. Over half the mortality risk (53.6 percent) among calves with less than 1,000 mg/dl IgG is associated with their failure to achieve adequate colostral immunoglobulin transfer. Since these calves represent 41 percent of the total, an estimated 22 percent of all deaths might be prevented by assuming adequate colostrum intake in all calves ($53.6\% \times 41.0\% = \text{population attributable fraction.}$)

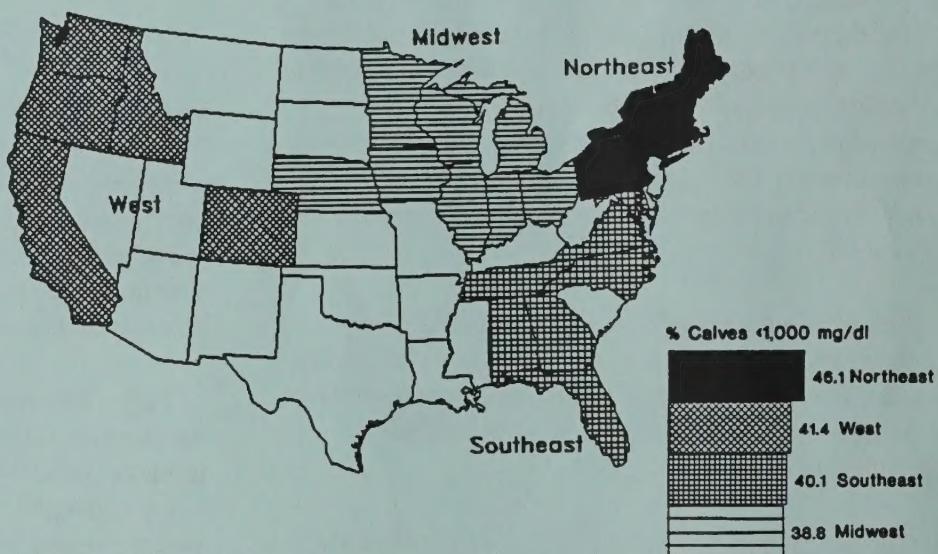
Figure 3 shows the relationship of herd size and percent of calves with low IgG levels (< 1,000 mg/dl). Very little influence of herd size was evident.

Figure 4 shows the distribution of IgG levels in newborn calves sampled in different seasons. Although more calves with low levels were found in the spring, a high percent of low IgG levels was noted year-round.

Figure 5 shows the percentages of calves with IgG levels of less than 1,000 mg/dl in four geographic regions of the United States. All regions had similar prevalences of calves with low IgG and no region had less than 38 percent.

Based on the data from the National Dairy Heifer Evaluation Project, at least 22 percent of all calf deaths

Figure 5. Percent of Calves with Immunoglobulin (IgG) Levels of < 1,000 mg/dl by Region



might be prevented by making better use of what nature provides free of charge. 🐄

NDHEP collaborators also included the National Agricultural Statistics Service (USDA:NASS), National Veterinary Services Laboratories (USDA:APHIS:VS), and State and Federal Veterinary Medical Officers. The Cooperative Extension Service provided editorial assistance. For more information on the National Dairy Heifer Evaluation Project and other NAHMS programs, please contact:

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